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Oil spill response in Japan

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OIL SPILL RESPONSE IN JAPAN

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Declaration

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

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ABSTRACT

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Oil spill response and preparedness is the one of the most important international maritime challenges.

In Japan, The Nakhodka oil spill which was occurred in 1997 is the worst oil spill accident from a vessel in the history of the country. This assessment of the experiences from this accident indicated that there were room for improvement in the country's oil spill preparedness and response. However, the oil spills do not only originate, but also from the vessels, but also offshore oil and gas industry. Deepwater Horizon oil spill began on April 20, 2010 in the Gulf of Mexico is fresh in our memory. This dissertation starts by examining the contingency plans in Japan, United States, and Norway. In the Norwegian case, studying about the oil spill from vessel, and in U.S. case, investigating the oil spill from the offshore industry based on Deepwater Horizon oil spill, and the Exxon Valdez oil spill. In a following chapter, the thesis investigates and assess the Japan's oil spill response which was renewed after the Nakhodka oil spill. A special attempt is made to assess the chain of command (management structure). In a concluding chapter, this study will do recommendations improvements in Japan's contingency plan including some recommendations regarding preparedness for spills from offshore oil and gas industry oil spill.

KEYWORDS: Contingency plan, chain of command, dispersants

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LIST OF ABBREVLATONS

ACP	Area Contingency Plan
ARPEL	Regional Association of Oil, Gas, and, Biofuels Companies in Latin America and the Caribbean
CeisNet	Coastal Environmental Information Service
EEZ	Exclusive Economic Zone
EPA	Environmental Protection Agency
ESI Map	Environmental Sensitivity Index Map
IPIECA	The global oil and gas industry association for environmental and social issues
ITOPF	The International Tanker Owners Pollution
JCG	Japanese Coast Guard
JRCC	Joint Rescue Coordination Center
Klif	The Climate Pollution Agency
LCP	Local Contingency Plan
METI	Ministry of Economy, Trade, and Industry
MMS	Minerals Management Services
NCA	Norwegian Coastal Administration
NCP	National Contingency Plan
NEBA	Net Environmental Benefit Analysis

NOFO	Norwegian Clean Seas Association for Operating Companies
NOTAM	Notice to Airman
NOWPAP	Northwest Pacific Regional Seas Programme
NRC	National Response Capacity
OPA	Oil Pollution Control Act of 1990
OSC	On Scene Coordinator
OSER	Oil Spill Emergency Response
PAJ	Petroleum Association of Japan
PSA	Petroleum Safety Authority
RETOS™	Readiness Evaluation Tool for Oil Spills
RRT	Regional Response Team
UNEP	The United Nations Environment Programme

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Chapter 1 Introduction

1.1Oil in the environment

1.1.1 Weathering processes acting on oil at sea

An oil spill on the sea will undergo a series of physical and chemical processes that will affect the characteristics and effects of the oil over the time. The changing chemical and physical processes are often called weathering. Figure 1 shows the typical weathering process which includes spreading, evaporation, dispersion, emulsification, dissolution, photo-oxidation, sedimentation and sinking, shoreline interaction and biodegradation. Among these phenomenon, spreading, evaporation, dispersion and emulsification are important in the early stages of the spill whereas photo-oxidation, sedimentation and biodegradation are long-term processes that determine the ultimate fate of the oil (ITOPF, 2011). Of these phenomena, emulsification is especially a nasty issue. Many oils take up water and form water-in-oil emulsions. This water-in-oil emulsion reduces the rate of other weathering processes (e.g. spreading or dispersion), and it is the main reason for the persistence of light and medium crude oils on the sea surface and shoreline (ITOPF2011). Once oil is spilled, it begins to weather and its physical and chemical characteristic change over time. Therefore, it is important to have a flexible response to spilled oil depending on the sextent of weathering of the oil.

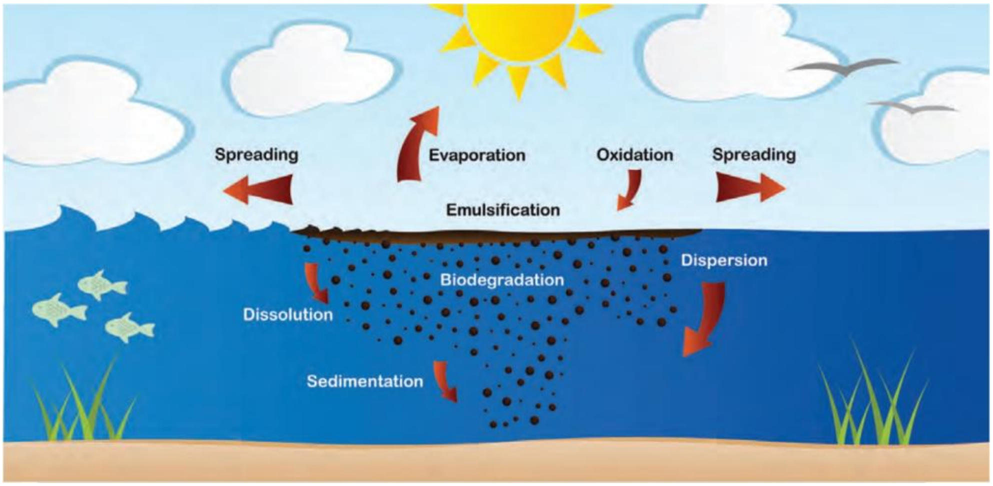

Fig.1 Weathering Processes Acting on Oil at Sea.

source: ITOPF TECHNICAL INFORMATION PAPER, FATE OF MARINE OIL SPILLS

1.1.2 Oil control equipment

As major examples, there are 3 kind of oil control equipment for use when the oil is floating on the water: “booms”, “dispersants” and “skimmers”. First oil control equipment is booms. It is the floating barriers designed to perform oil containment and concentration, deflection and protection. Of these functions, the most important one is oil containment or deflection capability, and it is determined by its behavior in relation to water movement. Oil booms can be a difficult and potentially hazardous operation during the deployment. When the oil spill accidents occur, the weather is mostly severe with rough seas. Therefore, high waves impose limitations on operations and the handling of wet and oily equipment on vessel that are pitching and rolling. Activities on beach under such circumstances demanding and can place personnel at risk. The second method to control oil spills at sea is the use of dispersants. As already discussed, some amount of the oil in the sea will disperse naturally (refer to Fig.1). Therefore, the characteristic of dispersants is to enhance natural dispersion by reducing the surface tension at the oil/water interface, making it easier for wave motion to create many smaller oil droplets. However, dispersants using has some important points. The most important factors for the successful use of dispersants are the sea conditions and the oil properties. Without a minimum amount of wave energy, the use of dispersants will not be successful, and most dispersants are unable to disperse very viscous oils and stable emulsions. The third method to deal with oil spills at sea is to use oil skimmers. A skimmer is a machine that separates oil or particles floating on a liquid surface. Skimmers are categorized as oleophilic skimmers, suction skimmers and weir skimmers based on their functions.

1.2 Oil Effluence Accident from Nakhodka Tanker

In 1997, the Russian tanker Nakhodka, weighing 13,157 tons, sank in the Japan Sea reportedly causing an oil spill which were at forms over detected a distance of 6,240 kiloliters. In spite of offshore oil collection attempts, and as a result of strong winds and rough winter weather, a large amount of spilled oil drifted into the Japan Sea. Consequently, vast amounts of this heavily emulsified oil washed up on the Japan Sea shorelines. The oil spill had a serious impact both ecologically on the shoreline environment and economically on coastal activities such as fisheries and tourism (Shimada & Kato, 2013). This accident indicated some problems in the Japanese oil spill response including in the chain of command (Questions were raised regarding: Who is in charge of the operation, and who is the manager of the clean-up?). Furthermore, issues that needed to be improved was to the initial response and the insufficient national contingency plan.

1.3 Oil spills from offshore industry

According to Ministry of Economy, Trade, and Industry (METI) in Japan, the output of oil and gas from offshore industry is decreasing from 2007. The cause of this decrease is low production figures in the oil and gas industry. At present circumstances, Japan has one offshore oil and gas field, Iwafune-oki oil and gas field. This oil and gas field was discovered in 1983 and production was commenced in 1990. The offshore platform was settled at 36 meters' depth, and cumulative oil production reached 500,000 ton in 2012.

However, METI continue to investigate the offshore oil and gas industry, even though the lower price of crude oil in the world. Therefore, due to innovation of drilling technology, along with extension of continental shelf, the possibility of finding oil and gas in offshore area will be increasing in the future. As a consequence, it will be important to be prepared not only for the pollution from the ships, but also the offshore incident in Japan.

1.4 Aim

The aim of this dissertation is to better understand the state of oil spill preparedness in Japan today and use the findings to recommend improvements. Oil spills refer to any oil pollution from ships, and offshore industry which has become more important recently. After the oil spill accident from Nakhodka tanker, Japan reviewed the contingency plan and the chain of command. Considering that this review, recent development in the area of oil spill contingency the fact

Therefore, it is a good time to review the oil spill preparedness, since approximately 20 years has passed since the Nakhodka tanker accident.

This research has been done by analyzing Japanese preparedness as a case study and explaining the cause of any deficiencies in national preparedness. Any oil spills, affecting the Japanese Territorial Sea or Exclusive Economic Zone (EEZ) are considered. This thesis seeks to answer the overall question “Can Japan handle big oil spills and how effective is the preparedness comparing to countries like Norway and the United States.”

The research questions are the following:

- What has the U.S. and Norway learnt from previous oil spill accidents, and how did you change oil spill response and preparedness system.?
- When the accident occurs, how are the chain of command and management in Japan, Norway and United Sates?
- Based on contingency plan, how is the emergency call network, and can this network use the available equipment efficiently?

- In training system or accident response, how do government corporate with stake holders and other parts of society?
- Comparing to other countries, what aspect is lacking in the Japanese national contingency plan?

1.5 Dissertation Structure

This thesis is divided into 4 chapters.

Chapter 1. Introduction

The first chapter describes the economic and environmental impacts of oil pollution. The chapter also discuss the present Japanese experiences which includes the Nakhodka tanker accident and the offshore platform. The chapter also presents research aims, questions, and the dissertation structure.

Chapter 2. Oil pollution at the sea

This chapter assess the Japanese experiences of oil spills including the Nakhodka tanker accident, and the national contingency plan before and after this accident. This chapter also examine Norway's oil spill contingency plan and management as an example, and compare the advantages and disadvantages between Japan and Norway in oil spill preparedness.

Chapter 3.

The third chapter treats oil spills from offshore industry. It describes the current condition of the offshore oil platform in Japan, Deepwater Horizon oil spill in the U.S. and based on this information, consider the effectiveness of regional and national contingency plan.

Chapter 4.

The last chapter contains an analysis and the conclusions based on chapters 2 and 3. Then making some proposal.

1.6 Conclusion

The combatting of the oil pollution from Nakhodka tanker, showed some deficiencies in the Japanese oil spill response, including a slow and ineffective initial response, problems in the chain of command and the slowness of reacting to the advice from experts. After this accident, Japan reviewed the national contingency plan, and continued training for oil spill. This thesis, will attempt to establish the present state of preparedness of the Japanese oil spill contingency, and compare it to other developed countries

Chapter2 Oil Spills from vessels

2.1 Oil spill Contingency Plan

2.1.1 Significance of Oil Spill Contingency Plan

The purpose of contingency plan is to provide the procedures and organizational structures for oil spills, and release the hazardous substances. In general, the oil spill contingency plan is categorized 3 parts based on the scale, “National Contingency Plan”, “Local Contingency Plan” and “Area Contingency Plan” (Murakami, 2001). However, each contingency plan mostly should comprise three parts, strategy section, action and operations section, and finally data directory (IPIECA, 2000). Firstly, a strategy section, which should describe the scope plan, including the geographical coverage, perceived risks, roles/responsibilities of those charged with implementing the plan and the proposed response strategy. Secondly, an action and operations section, which should set out the emergency procedures that will allow rapid assessment of the spill and mobilization of appropriate response resources. Finally, a fata directory, which should contain all relevant maps, resource lists and data sheets required to support an oil spill response efforts and conduct the response according to an agreed strategy (IPIECA, 2000).

2.1.2 Response Policy

When making contingency plan, it is important to clarify the response policy clearly. The typical example is the method of recovery. For instance, United Kingdom of Great Britain and Northern Ireland (U.K.) is known to use chemical recovery aggressively. However other countries including Norway, Sweden or Japan have the priority to use the mechanical collection. The reasons for these differences in policy is due to oceanographic conditions and how the countries prioritize environmental damage.

2.1.3 Net Environmental Benefit Analysis

When considering about making contingency plan, Net Environmental Benefit Analysis (NEBA). NEBA is a methodology for identifying and comparing net environmental benefits of alternative management options, usually applied to contaminated sites (Efroymson, 2004). This concept is useful to consider about oil spill response, which tool will minimize impact on the environment and community. As already discussed, the strategy how to deal with an oil spill (whether to use dispersants, focus on mechanical recovery, and physical recovery) have benefits and drawbacks. Therefore, in this chapter, it clarifies how to make use of NEBA, then clarifying previous spill histories.

Firstly, an assessment is made how to make NEBA in each oil spill combatting scenario: recovery, mechanical recovery, physical recovery or using dispersants. Each method has benefits and drawbacks. Dispersants can remove surface oil that could affect wildlife and keep oil from spreading to shorelines. In addition to this, they enhance natural biodegradation of oil. Nevertheless, dispersed oil has the potential to affect water column-dwelling organisms and vegetation. Then, mechanical recovery can remove oil with minimal environmental impact, however, mechanical recovery is extraordinarily slow and labor-intensive, with typically no more than 10-20 percent oil recovered. Lastly, physical removal can reduce secondary impacts to animals that reside on shoreline and prevent remobilization of the oil. However, aggressive removal methods may impact shoreline and shore organisms, again with typically no more than 10-20 percent oil recovered.

The planning phase for a NEBA, which is comparable to the planning and problem formulation phases in risk assessment (EPA 1998), includes setting the goals of assessment, selecting a limited and feasible suite of alternative actions, defining the temporal and spatial scope of assessment, identifying contaminant and remediation stressors, selecting environmental services and other ecological entities, selecting metrics and methodologies for the comparison of alternatives, selecting measures of exposures and effects, selecting a reference state, establishing a link between stressors and services (conceptual model), and developing an analysis plan (Fig.2). A comparative assessment such as a NEBA should have a plan that encompasses relevant actions.

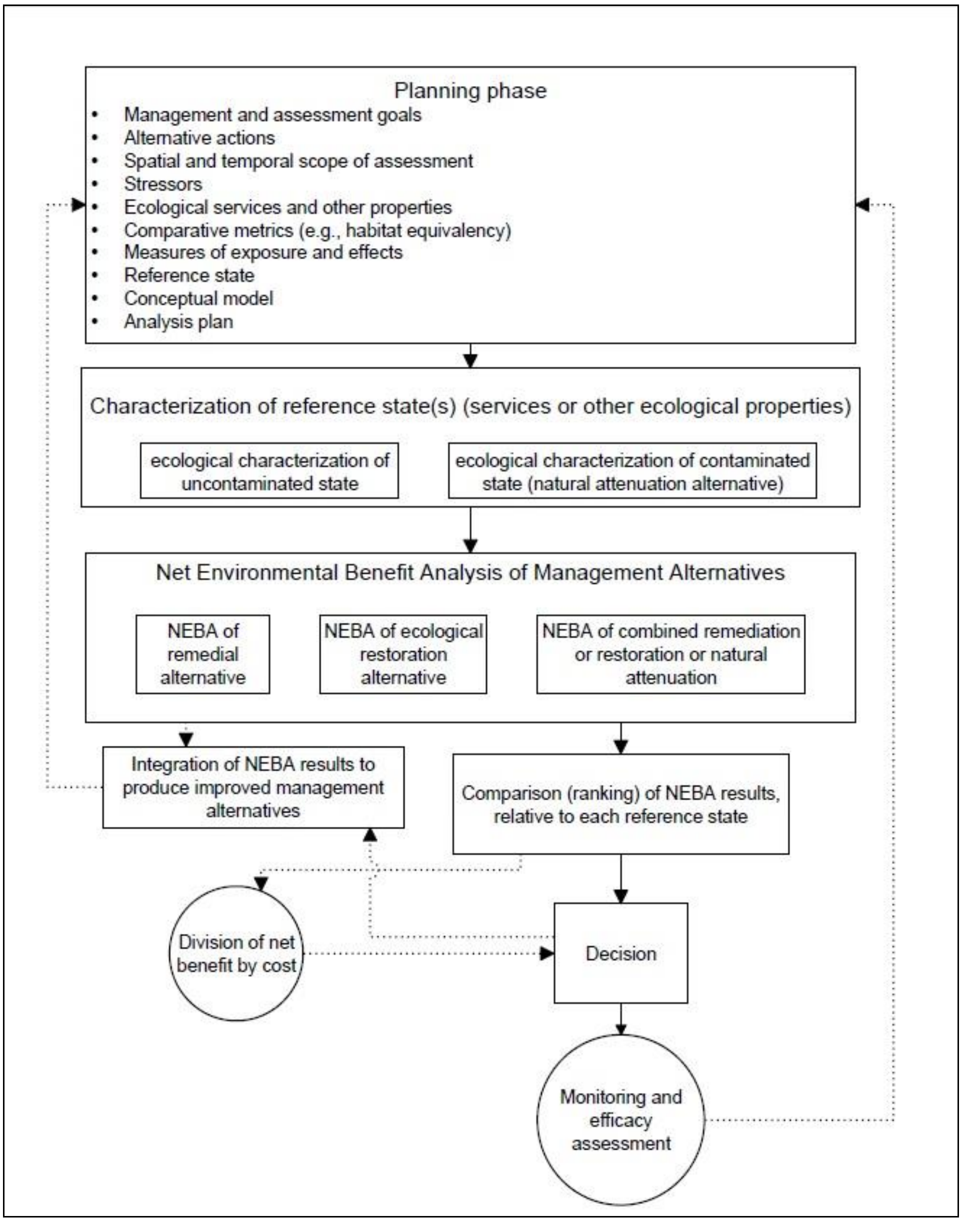

Fig.2 Framework for Net Environmental Benefit

Source: A Framework for Net Environmental Benefit Analysis for Remediation or Restoration of Petroleum-Contaminated Sites

2.2 Oil Spill Response in Japan

2.2.1 National Contingency Plan

Japan's national contingency plan was decided by cabinet in 1995, after Nakhodka accident. In addition to this accident, this plan was amended in 2006, in response to Protocol on Preparedness, Response and Cooperation to pollution Incidents by Hazardous and Noxious Substances, 2000 (OPRC-HNS Protocol). The amendments in 2006 has 2 points. Firstly, the changing of object substances. Secondly, noting about "am emergency team composed of the director generals of the respective ministries and agencies" (Ministry of Environment). The national contingency plan has 18 pages, and also they have 204 pages' materials.

The composition of Japan's national contingency plan is as followed.

Chapter1 Introduction

Section1 the purpose of this plan

Section2 the relationship with other plans

Chapter2 Basic matters about the preparedness of oil spills

Section1 Comprehensive development

Section2 Adjustment of response system

Section3 Adjustment report and contact system

Section4 Adjustment related equipment

Section5 Training

Section6 Regional cooperative structure

Chapter3 Basic matters about the correspondence with oil spills

Section1 Basic concept about the protected matters

Section2 Establishment of correspondence system

Section3 Contact system with regard to oil spills

Section4 Evaluation of oil spills

Section5 Implementation of countermeasure

Section6 Provision of information about oil spill equipment

Section7 Health and safety management of pest control work practitioner

Section8 Implementation of the rescue of wildlife

Section9 Implementation of fisheries conservation measures

Section10 Securing of maritime traffic safety and risk prevention measures

Section11 Public relations

Section12 implementation of the post monitoring

Chapter4 Mutual cooperation of the relevant administrative organizations

Section1 National cooperation

Section2 Regional cooperation

Chapter5 Others

Section1 Promotion of research and technology development

Section2 Review of this plan

2.2.2 Local Contingency Plan

Based on “Act on Prevention of Marie Pollution and Maritime Disaster”, Japanese Coast Guard (JCG) categorized sea area as 16 parts. In this section, it aims to invest the “Tokyo bay oil spill contingency plan” as example.

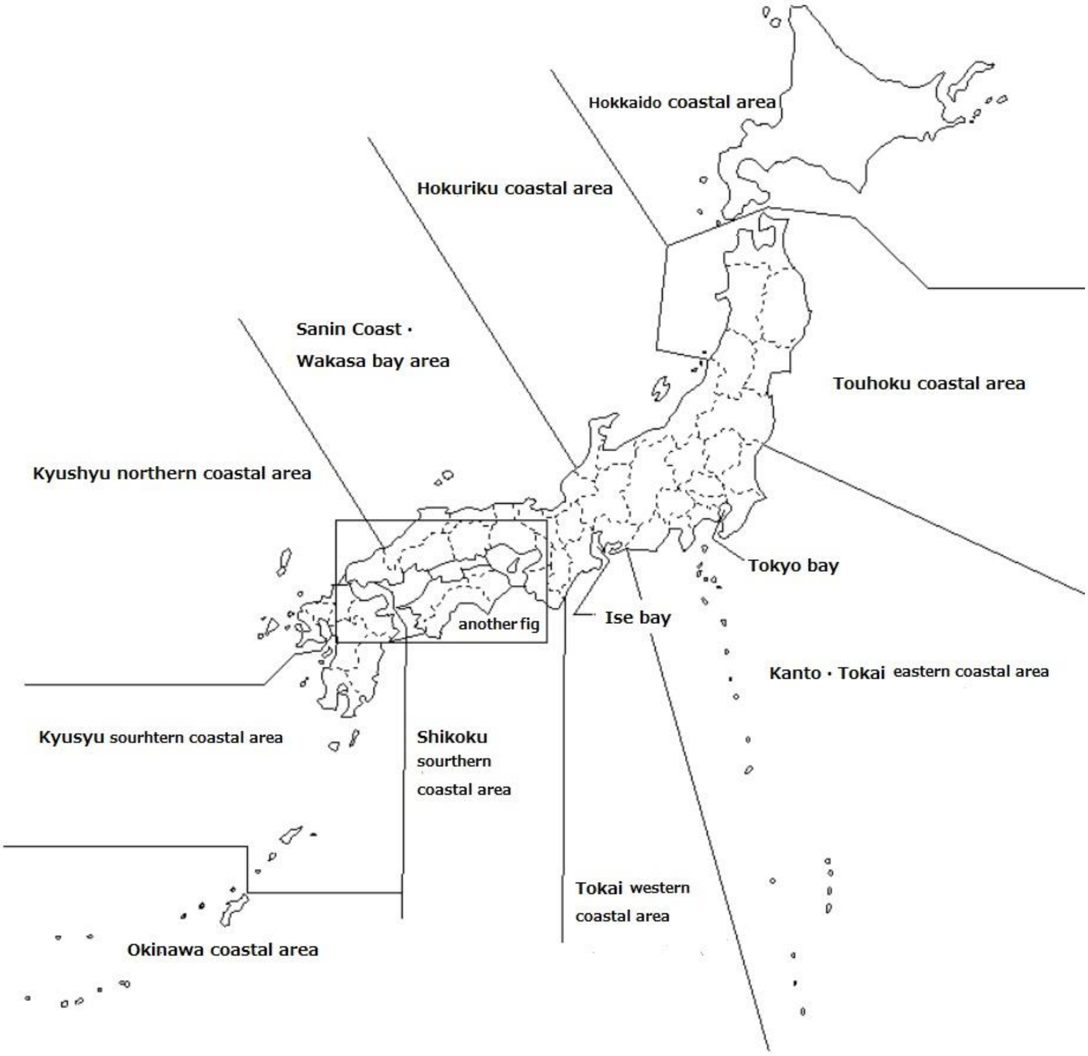

Fig.3 Target sea areas and Names (1)

Source: Japanese National Contingency Plan

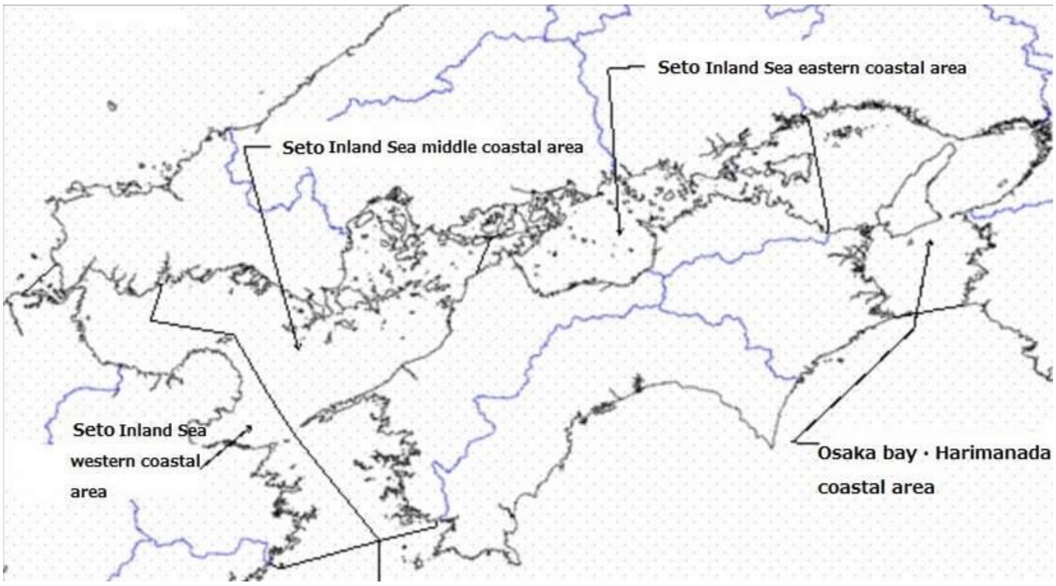

Fig.4 Target Sea Areas and Names (2)

Source: Japanese National Contingency Plan

The composition of “Tokyo bay oil spill Contingency plan” is as followed.

Part1 General rules

1. Purpose
2. Target sea area of this plan
3. Basic policy
4. Modification of this plan

Part2 Ocean area

Chapter1 the current situation

1. Overview
2. Oil storage facilities
3. Mooring facility
4. Maritime traffic situation
5. Marine accident situation
6. Occurrence of marine pollution
7. Weather and sea condition
8. Fishing industry

9. Surrounding environment

Chapter2 Assumption of marine pollution

1. Assumption of oil spills
2. Basic policy about marine pollution

Chapter3 Prevalence of oil spill control materials and maintenance goals

1. Storage situation
2. Maintenance goals

Chapter4 Communication and exchange of information

1. Communication
2. Exchange of information
3. Marinating the communication measures
4. Communication and exchange of information

Chapter5 Risk Prevention

1. Control of the discharged oil and preventing the danger
2. Notes of the target sea area

Part3 Control measures of oil spills in the open ocean

1. Weather and sea condition
2. Current status of the oil spill control equipment
3. Control of the discharged oil and prevention of the danger

This regional oil spill contingency plan is categorized 3 parts, general rules, ocean area, and control measures of oil spills in the open ocean. General rule describes the purpose of this plan, basic policy and target sea area. The second part is categorized 5 chapters, the situation of target sea area, assumption of marine pollution, prevalence of oil spill control materials and maintenance goals, communication and exchange of information, and risk prevention.

The situation in target sea area e.g. storage facilities, fishing industry and marine traffic is described in the first chapter. The second chapter discuss the risky of pollution of marine pollution and notes the 2 critical factors, the weather and the amount of discharged oil. The third chapter describes the available of oil spill control materials and maintenance goals. It discusses the current situation and target depending on the above assumptions. The fourth part shows the communication flow charts. Finally, the fifth part discuss risk prevention and notes importance of the initial response, control system and operation manual about the oil spill.

2.3 Specific Spill Response Based on Contingency Plan in Japan

As already discussed, Japan review the emergency management after Nakhodka oil spill accident. In this chapter, it aims to clarify the Japanese oil spill response management based on Oil Spill contingency plan, especially about “A chain of command”, “Sensitivity map”, “Response Equipment”.

2.3.1 A Chain of Command

According to the “National Contingency Plan” chapter 3, the chain of command among the national government is showed. The chain of command roughly categorized 3 stages. In the first stage, When the oil spill accidents occur, “concerned administrative authorities” open “Liaison Council for Ministries and Agencies” to check and share the information as necessary. In the second stage, when the oil spill accidents occur, and it needs information aggregation and mutual contact among the respective ministries and agencies, the government appoints “an emergency team composed of the director generals of the respective ministries and agencies” in the cabinet crisis center. In addition to this, the government establishes the emergency response office in the cabinet crisis center. In the third stage, if coordination of emergency response needs strongly, government set “Alert Headquarters” in Japanese Coastguard headquarters, and “The on-site Liaison and Coordination Headquarters” in the accident site. The managers of each headquarters are written as Director General of Japanese Coast Guard and Commander of a Regional Coast Guard headquarters. Therefore, Japanese Coast Guard is in charge of substantial command.

In conclusion, the issues about a chain of command in the oil spills are mostly resolved for the time being. When the oil spill accident occurs, “Alert Headquarters” in Japanese Coastguard headquarters which is controlled by Director General of Japanese Coast Guard will be in charge of the accident, and they contact and share the information with the Cabinet Crisis Center and the On-Site Liaison Coordination Headquarters.

2.3.2 Sensitive Map

Making and updating sensitivity maps are key activities in the planning process. These maps convey essential information to spill responders by showing where the different coastal resources are and by indicating environmentally sensitive areas (IPIECA, 2000).

According to IPIECA, the sensitivity map should be included with protected area, important areas for biodiversity (not legally protected), sensitivity ecosystems, critical habitats, endangered species and key natural resources are considered sensitive to oil spills. The reason is that they are of environmental, economic, or cultural importance, at risk of coming in contact with spilled oil, and likely to be affected once oiled or affected by the oil even without direct contact.

In addition to this, they also notice that sensitivity maps are useful for every levels, “decision maker”, “On-Scene Commanders and Operations Managers”, and “On-Site Responders”. However, the importance of each of them are different. For instance, the role of decision maker is defining general response strategy at national or regional level (mobilized for big oil spills), the task of On-Scene Commanders and Operations Managers is developing response tactics to respond to spill and manage operations in the field, and the role of on-site responders is implementing operations on site. Therefore, the maps should also be categorized “Strategic maps” for decision makers, “Tactical maps” for On-Scene Commanders and Operations Managers, and “Operational maps” for On-Site responders.

Strategic sensitivity maps are developed, at a smaller graphic scale, to provide a broader perspective and to synthesize information, locating and prioritizing the most sensitive sites. The decision makers would use these maps with the objectives of locating and prioritizing the most sensitive sites, and to reinforce the response capabilities for these areas during the preparedness effort) and resolve the issue of competing priorities in the event of limited protection and clean-up resources during an incident.

Tactical sensitivity maps are used as a general planning and response tool. During an incident, they are used by the people in charge of the coordination of the operation on site (the On-Scene Commanders) and in the incident command post (Operations Manager). These maps provide responders with all required environmental, socio-economic, logistical and operational information to plan and implement response and protection operations. They can include additional information to assist the user (clean-up technical guidelines, environment protection and restoration recommendations, etc.).

Operational sensitivity maps are optional. They may be developed only for the most sensitive sites identified, at a much larger scale than strategic or technical maps, and are designed to be used by the on-site responder. They include information on the general logistical and operational resources (as on the tactical sensitive maps) and, more importantly, sit-specific information to provide detailed information for on-site oil spill responders.

In Japan's case, Japanese Coast Guard (JCG) is in charge of Coastal Environmental Information Service & Environmental Sensitivity Index. They provide the location which storages the oil spill response equipment, the natural environment which will be affected by the oil spill and the location and information of related facility. In particularly, they provide 2 important types of information, the first one is "Coastal Environmental Information Service (CeisNet) ", and the second one is "Environmental Sensitivity Index map (ESI map)". CeisNet is the online service which provides coastal environmental information service. They offer these services through Web Geographical Information System (Web GIS). ESI map is pdf format map, and the number of the maps are 100, which covers all of Japanese coast.

Environmental Sensitivity Index (ESI) is adopted for clarifying for the various types of shoreline (and river or lacustrine ecosystems). The ESI, ranging from 1 (low sensitivity) to 10 (very high sensitivity) integrates the shoreline type (grain size, slope) which determines the capacity of oil penetration and/or burial on the shore, and movement; exposure to wave (and tidal energy) which determines the natural persistence time of oil on the shoreline; and general biological productivity and sensitivity (IPIECA, 2000). the colour code of sensitivity code is as followed.

Fig.5 Colour Code of the Environmental Sensitivity Index

Source: Sensitivity mapping for oil spill response

In conclusion, JCG has already prepared the tactical sensitivity maps as the oil spill response authority. Except these maps which made by JCG, some of local government have developed their own sensitivity maps.

2.3.3 Response Equipment

JCG equipped the oil spill response equipment in each region based on the contingency plan. In addition to this, after the Nakhodka oil spill accident, “National Strike Team Basement” was equipped in Yokohama. National Strike Team is the expert team in Japanese Coast Guard. The National Strike Team provides guidance and advice on how to control oil and hazardous and noxious substances that have spilled into the sea, as well as on extinguishing and preventing the spread of fires at sea. It also coordinates with involved parties and carries out disposal measures of its own as the situation demands.

In addition to the preparedness by the Government effort, the private sector also has the duty to provide oil spill response preparedness. Japan defines the cooperative structure based on “Act on Prevention of Marine Pollution and Maritime Disaster”. According to the article 39 (3), it notes the ship owner’s obligation to be prepare for pollution response and clean-up measures. Such a response capability should be based on OPRC – HNS convention.

In the private sector, Petroleum Association of Japan (PAJ) built up and maintains the stockpile bases of oil spill response equipment, and maintenance contractors are implementing appropriate and periodical check-up of the devices. By the end of June 1996, 11 stockpile bases are completed and ready for use (Figure3). Six bases in Japan are located in the premises of refineries faced six major waters (PAJ, 2012).

Base	1 Tokyo Bay	2 Seto Inland Sea	3 Ise bay	4 Sea of Japan	5 Hokkaido	5 Hokkaido	6 Okinawa
Location	Ichihara	Mizushima	Yokkaichi	Niigata	Muroran	Wakkanai	Uruma
Solid boom (m)	7,240	4,200	2,280	2,120	2,120	960	2,280
Inflatable boom (m)	1,702	1,630	1,452	1,630	1,630	322	1,440
Oil skimmer	10	13	16	11	11	2	9
Inhalable barg (tonn)	25	25	25	25	225	0	25

Table1 Japan’s Equipment Stockpile Bases and Equipment

Source: MAJOR OIL SPILL RESPONSE PROGRAMME

In order to determine the response equipment, the government has to decide their response policy clearly. In Japanese case, National Contingency Plan chapter3(5) notes the prevention measures to oil spills. However, it is not enough to show the measures. National Contingency Plan should also write detailed usage standards. (Murakami, 2011). Among that, using the dispersants is critical issue. Dispersants can be an effective response to oil spill and can minimize or prevent damage to important sensitive resources (ITOPF, 2011). In common with other response techniques, the use of dispersants must be considered carefully, to take into account oil characteristics, sea and weather conditions, environmental sensitivities and national regulations on dispersant use (ITOPF, 2011).

In using dispersants, there are 3 important factors to be considered: dispersant choice, environmental considerations, and timing. Firstly, dispersants are manufactured according to different formulations, and their effectiveness varies with oil type (ITOPF 2011). Therefore, it is necessary to choose the appropriate dispersant in each oil spill care. Secondly, despite improvements in dispersant formulations, the toxicity of the dispersant/oil mixture to marine fauna and flora is often the major environment concern (ITOPF, 2011). Finally, avoiding delays at the time of a spill is a key factor. The decision on whether dispersants can be used and if so, the precise circumstances under which they may be used need to be agreed during the process of developing contingency arrangements for oil spill response.

In Japan’s contingency plan, there is regulation about the using about dispersants. However, there are some restrictions and the main response method regarding their use. The contingency plan considers mechanical collection, using oil booms, skimmers etc. The contingency plan also notes the timing when dispersants can be used. According to the plan dispersants use should be preceded by consultation with stakeholders. However, when an accident occurred, it is too late to consult with stakeholders after the oil spill accident. Therefore, prior consultation with stakeholders about the condition and timing of using dispersants.

2.3.4 International Cooperation

As international effort, Japan cooperated with Russia, Chania, and South Korea. The typical international effort is establishing “The Action Plan for the Protection, Management and Development of the Northwest Pacific Regional Seas Programme (NOWPAP)”. It was adopted in September 1994 as a part of the Regional Seas programme of the United Nations Environment Programme (UNEP).

The Northwest Pacific region features coastal and island ecosystems with spectacular marine life and commercially important fishing resources. The region is also one of the most densely populated parts of the world, resulting in enormous pressures and demands on the environment.

The overall goal of the Northwest Pacific Action Plan is “the wise use, development and management of the coastal and marine environment as to obtain the utmost long-term benefits for the human populations of the region, while protecting human health, ecological integrity and the region’s sustainability for future generations”.

2.3.5 Current Situations

In 2014, JCG checked 235 oil spill response accidents. Compared to 2013, the number of oil spill disaster has declined 22. The JCG advised and guided to the polluters, because of polluter-pays-principle. Among of oil spill response, 125 of oil spills are large-scale or not enough polluter-pays-principle, so JCG corresponded with them (JCG Annual report 2015).

2.3.6 Conclusion

Japan’s OSER was dramatically changed after Nakhodka oil spill accident. In this accident, it was criticized the unclearness of chain of command (who in charge of the accident). In addition to this, too few disposal options were available for clean-up managers to consider (ITOPF, 1999). Therefore, as part of national contingency plan review, efforts should be made to identify more economically viable options for storage and separation of oil waste for recycling and recovery.

Compared to the previous National Contingency Plan the revised one contains three important changes. The first one is a revised chain of command based. The second on is the establishment of sensitivity maps. The last one is enhancing the response equipment. Firstly, the National Contingency plan notes placing “Alert Headquarters” in Japanese Coastguard headquarters, and “The on-site Liaison and Coordination Headquarters” in the accident site. Therefore, it is cleared that the Director General of JCG manages and take command. The National Contingency Plan also shows the structure of the cabinet. Secondly, JCG made the sensitivity maps after the Nakhodka oil spill accident. The first one is “Coastal Environmental Information Service (CeisNet) “, and the second one is “Environmental Sensitivity Index map (ESI map)”. These maps show the sensitivity and resilience in different types of coasts through different colours and lines. Finally, Japan enhanced the oil spill response equipment both in the governmental and private sectors. In the Local contingency plan, they note the current number of the oil spill response equipment and the future targets of the response capacity. In addition to this, JCG enhanced the national Strike Team. This team aims to be a specialist for dealing with the marine oil and other dangerous hazardous spills.

However, Japan did not solve the issues about the timing of using dispersants. In Local Contingency Plan, it is noted that dispersants may be used after discussing with stakeholders (including fishing and tourist industry). However, how this will be done in a meaningful way during an oil spill emergency is not explained.

2.4 Oil Spill Response in Norway

The Norwegian National Oil Spill Emergency Response (OSER) system is a multi-level system based on private, municipality, and state system. There is a division of labour between the different levels identified in the contingency plan. Companies (operators), terminals, and Clean Seas Association are to provide OSER for spills caused by their operations (largely offshore petroleum). Municipalities (430 in number) and inter-municipal emergency response regions (further inter-municipal regions) are set up to handle smaller spills and shoreline operations. The state system led by the Coastal Administration is aimed at oil spills from marine shipping and larger incidents (Sydnes, 2011). Among those, the Norwegian Coastal Administration (NCA) is the primary government agency responsible for safeguarding the coastline, including ensuring preparedness in cases of acute pollution. The NCA's Department for Emergency Response is located in Horten. An Emergency Response Centre which reports to the Department of Emergency Response has the operational responsibility for the government response. NCA has established 27 oil response depots along the coastline, 16 of which are main depots (ITOPF, 2011). The Norwegian OSER is a complex structure with private, municipal, and state-level sectors. However, when needed the different levels of contingency (or units therein) may request support from other response providers. In the Norwegian OSER system all providers of services are required by law to provide assistance when required. The duty to assist and cooperate is ensured by a compensation scheme that guarantees that all coasts derived from providing such assistance will be reimbursed (PCA 1981 2;76). PCA 1981 also notes the three levels of contingency are to operate as a single integrated response operation when required. Therefore, in the case of an oil spill, the Coastal Administration will monitor OSER operations and may enter or take over such operations when deemed necessary (PCA 46). There are no formally established criteria for when the Coastal Administration may take control over OSER operations (PCA 46)

2.4.1 Response Policy

The primary objective of Norwegian spill response is to contain and cover the oil as close to the source as possible. Chemical dispersion is considered to be supplementary to physical removal. To this end, every organization required to have an oil spill contingency plan should consider dispersant use as a strategy. The Climate and Pollution Agency (Klif), under the Ministry of Environment, is the competent authority for dispersant approval and regulations. NCA authorities dispersant use in situations where dispersants would be beneficial but the conditions have not been laid out in a contingency plan as part of requirements from Klif. Applications for the use of dispersants should be based on a Net Environment Benefit Analysis (NEBA) (ITOPFF, 2011). When private sector uses the dispersants, the company has to apply for a permit from the NCA.

2.4.2 Pollution Control Act 1981

The Pollution Control Act of 1981(PCA 1981) is the legal basis that establishes the general requirements for the OSER system and the basic principles, demands, and obligations to the organizations involved in activities that may cause acute pollution in Norway (PCA1981).

2.4.2.1 The Outline of Pollution Control Act

The Pollution Control Act of 1981 is the basic regulation that sets the preconditions for oil spill emergency preparedness in Norway, and which describes demands and obligations of the different parties. In accordance with the Pollution Control Act, a system has been established that applies to three levels.

First, oil companies have the primary responsibility for dealing with acute pollution closest to the source. Offshore oil and gas projects as well as largest facilities on land need to have oil spill preparedness systems in place. The companies operating on the Norwegian Continental Shelf have organized themselves into the Norwegian Clean Seas Association for Operating Companies (NOFO), which manages emergency response systems, develops contingency plans and supports research and development of oil response equipment. In case of an accident, the use of mechanical equipment is the primary strategy and the companies are required to have response equipment in place for each individual project.

Second, coastal municipalities have an important operational responsibility. They are obliged to have necessary equipment in stock to deal with smaller, acute spills and should be able to provide crews with equipment in case of an emergency. Norway is divided into 34 emergency-regions, each with an inter-municipal committee for acute pollution. The Coastal Administration considers these committees as the core of the total Norwegian preparedness network.

Third, the state is responsible for emergency response in case of major incidents of acute pollution when spill response by private and municipal preparedness is not sufficient. The state shall prevent acute pollution and ensure that the responsible polluter or municipality takes appropriate measures when acute pollution occurs. The overall responsibility for oil spill preparedness in Norway lies with the Ministry of Transport and Communications, with the Coastal Administrations as advisory, planning, controlling, and executive bodies. In the NCA, the Incident Command Team, has the important role to control the overall progress of the oil spill recovery. Apart from the Coastal Administration (NCA), other governmental agencies have important roles. The Petroleum Director (Ministry of Petroleum and Energy) and the Petroleum Safety Authority (Ministry of Labour and Social Affairs) have monitoring and reporting responsibilities. The responsibility for follow-up lies with the Norwegian Environment Agency (subject to the Ministry of Climate and Environment), which plays an important role in establishing environmental regulations for petroleum activities. It sets the criteria for the environmental equipment for preparedness systems and monitors compliance with the environmental regulations. With respect to the environmental effects of oil and gas activities, the Ministry of Climate and Environment has the overall responsibility (Figure. 5)

Fig.6 Outline of the Organization of Central Government Responses

Source: Norwegian National Contingency Plan

2.4.2.2 Notification Procedures

The Pollution Control Act regulates the notification procedures the event of an acute oil spill (Fig. 6). The notification procedure stipulates that any information regarding an oil spill is submitted to the Norwegian Coastal Administration. The notifications will be in the form of direct telephone contact or a report depending on the level of emergency. When an oil spill occurs, vessels must notify one of the Joint Rescue Coordination Center (JRCC) or the nearest coastal radio station. The operator of a petroleum installation must notify the Petroleum Safety Authority Norway (PSA).

When an aircraft observes an oil spill, the crew must notify the Notice To Airmen (NOTAM) office. Finally, land based operations must be notified via the emergency services 110 (911) which goes to the fire brigade. All related organization, JRCC/coastal radio station, PSA, NOTAM and 110 (911) have all their own instructions that regulate how and when they should notify NCA.

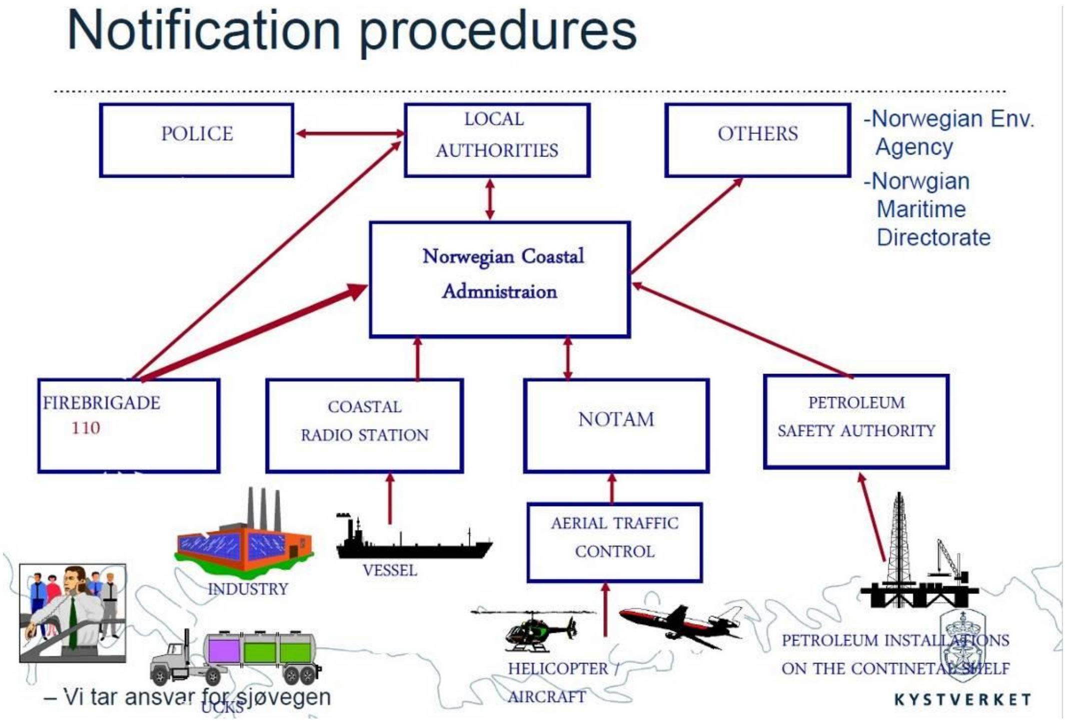

Fig.7 Notification Procedures of Norwegian Oil Spill

Source: Norwegian Coastal Administration

2.4.3 National Contingency Plan

In section 43, subsection 3 of the Pollution Control Act, authority has been delegated to the Norwegian Coastal Administration (NCA) to ensure the best possible coordination of operational emergency preparedness for acute pollution in a national system. Therefore, the National Contingency Plan (NCP) has been drawn up as part of the fulfilment of the duty. It does not establish any new duties for the agencies mentioned. However, the NCP facilitates fulfilment of their responsibilities to establish their own plans for ensuring that they can contribute to the NCA's coordinated emergency preparedness for acute pollution. The legal basis of NCP is the Pollution Control Act, Harbour Act, and Svalbard Environmental Protection Act.

The NCP is divided into private, municipal and governmental contingency areas with specific responsibilities based on Pollution Control Act.

All contingency plans and organizations are standardised and coordinated so that in the event of a major national emergency, the national contingency system will work as a single integrated response organization. The system is highly developed with equipment widely distributed through the country. Industrial plants that might cause significant oil pollution are obliged to establish an adequate level of preparedness. Governmental requirements primarily apply to operators on the Norwegian Continental Shelf, the crude oil terminals refineries and companies distributing oil products as well as major industrial companies (ITOPF, 2011).

2.4.4 The Response Requirement

The NCA maintains the response equipment which the government is in charge of. This equipment is stored in response depots along the coast, which hold a variety of booms, skimmers, off-loading units and other response kit. In addition, there are booms and skimmers as well as smaller equipment, protective clothing etc. stored on 9 Coast Guard vessels and 4 specialized recovery vessels operated by the Coastal Administration. Also, a number of naval defence vessels are on contract, capable of oil recovery, transportation or acting as lead offshore command vessels. Vessels from the civilian coastal patrol (Norwegian Sea Rescue) can also be used, as well as vessels of opportunity such as fishing boats.

In addition, the private sector is in charge of the response equipment. NOFO has a number of large supply ships as its disposal, which can be converted for oil recovery operations at short notice. NOFO also maintains 5 equipment depots, at Stavanger, Mongstas, Kristiansund, Treana and Hammerfest. These depots have similar, compatible equipment, consisting of large heavy duty containment system. In addition, NOFO have contracted helicopters to enable infra-red photography with a down link system with responding ships, allowing oil movement monitoring and recovery both a day and night, for limited dispersant spraying operations. The oil industry also maintains large stockpiles of equipment, including vessels, at the oil refinery terminals of Statoil Mongstad and Esso Splagen and the crude oil terminal of Norsk Hydro Sture. Several bunker stations have small amounts of equipment. Because of the extensive range of equipment held by national and local government agencies and the oil industry, there is little need for private clean-up contractions in Norway.

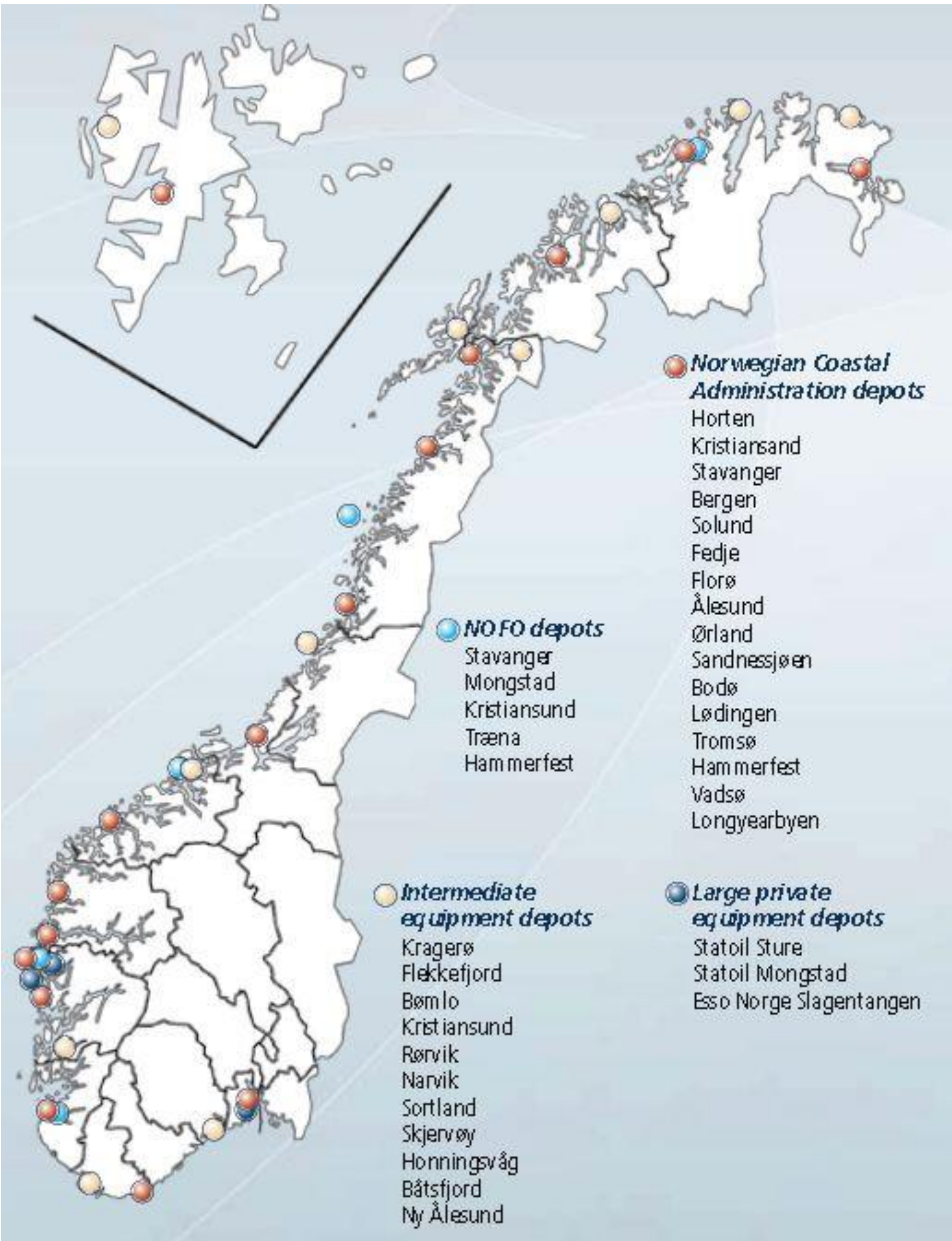

Fig.8 Equipment Depots for Oil Spill Response

Source: Norwegian Coastal Administration

2.4.5 International Cooperation

With the northwards expansion of offshore petroleum activity into the Arctic Ocean, there is a concern of the adequacy of emergency response system. Oil exploration and production in these areas is challenging due to harsh weather conditions, darkness, ice, icing, and large distances. Norway cooperates with other countries, Canada, Denmark, Finland, Iceland, Russia, Sweden, and the United States as a member of Arctic Council.

In this section, a general description is given regarding how to operate under severe Arctic conditions. Furthermore, the role of the Artic Council will be reviewed. In addition, a review will be given regarding the recent guidelines oil spill preparedness and response in the Arctic.

As means for the international cooperation in Arctic region, the Ottawa Declaration established “Arctic Council” as a high level intergovernmental forum to provide a means for promoting cooperation, coordination and interaction among Arctic States, with the involvement of the Arctic Indigenous communities and other Arctic inhabitants on common Arctic issues, in particular issues of sustainable development and environmental protection in the Arctic (Agreement on Cooperation, 2014). The Council’s activities are conducted in 6 working groups, which include individual mandates and a common structure comprised of a chairmanship (which rotates through the member states), a management board or steering committee and a supporting Secretariat. Each working group includes representatives from the Arctic Council member states and representatives from the Permanent Participants. In addition, group meetings may be attended by observe states, observe organizations, or invited guests or experts to participate at meetings or in projects. All working groups operate under the Principle of Consensus. The six groups are 1) Arctic Contaminants Action Program (ACAP), 2) Arctic Monitoring and Assessment Programme (AMAP), 3) Conservation of Arctic Flora and Fauna (CAFF), 4) Emergency Prevention, Preparedness and Response (EPPR), 5) Protection of the Arctic Marine Environment (PAME), 6) Sustainable Development Working Group (SDWG).

Among these groups, EPPR, AMAP and PAME are relevant when it comes to oil spill preparedness and response and preparedness. EPPR addresses different aspects of prevention, preparedness and response to environmental emergencies in the Arctic. EPPR was established by the declaration on the protection of the Arctic environment, which was signed June 14, 1991 in Rovaniemi, Finland. The aim was to establish a network for information on Arctic accidents and for facilitating, co-operation among the Arctic states around emergency prevention, preparedness and response (11).

PAME has the key responsibility for the Council's activities related to the protection and sustainable use of the Arctic marine environment. In 1997, PAME published its first report on Arctic offshore oil and gas guidelines. This was updated in 2002 and 2009. Another important document resulting from the Arctic Council's work on these issues is the AMAP Working Group's Arctic Oil and gas 2007 assessment in which the PAME and EPPR working groups participated. The objective was to present a holistic assessment of the environmental, social, economic and human health impacts of current oil and gas activities, and to evaluate the likely course of development of Arctic oil and gas activities and their potential impacts in the near future. The report included some key findings related to emergency response in the Arctic. Generally, responding to major oil spills remains a challenge in remote, icy environments. One of the conclusions of the AMAP report was that there are no effective means of containing and cleaning up oil spills in broken sea ice.

The task force and guidelines about oil spill response and preparedness

In addition to 6 working groups, there are several task forces that operate within the framework of the Arctic Council, based on Arctic Council rules of procedures article 28. The task forces are appointed at the Ministerial meetings to work on specific issues for a limited amount of time. The task forces are active until they have produced the desired results, at which point they become inactive.

As the current task force related to oil spill response and preparedness, the Nuuk Declaration, on the occasion of the Seventh Ministerial Meeting of the Arctic Council, outlined the Council's intention to establish a task force to develop an international instrument on oil pollution preparedness and response (the Agreement) in May 2011. This agreement was considered an important step forward on Arctic State cooperation in preparing for the increase in oil and gas and shipping activities that are expected to occur in the coming years. Initial challenges included establishing the geographic scope or areas of application, and the commitment to a legally binding or non-binding agreement.

Overall, the Agreement serves largely as a means to operationalize, in the unique conditions of the Arctic, the broader international Convention on Oil Pollution preparedness, Response and Co-operation 1990, to which all Arctic States are party. It provides for parties to cooperate and assist a Party which requests assistance to respond to an oil pollution incident. Key elements of the Agreement also include commitments to:

1) provide mutual assistance in the event that an oil spill exceeds one nation's capacity to respond
2) undertake appropriate monitoring activities to identify oil spills in areas within a party's national jurisdiction
3) promote cooperation and coordination among the Parties by endeavouring to carry out joint exercises and training
4) promote the exchange of information that could improve the effectiveness of response operations
5) conduct a joint review of activities undertaken during a coordinated response operation.

2.4.6 Previous Experience

Norway has suffered a number of ship-source spills. In 2007, the bulk carrier MV SERVER ran aground some 30 nautical miles north of Bergen spilling an estimated 375 tonnes of IFO 180. Shoreline clean-up operations were conducted using mainly local labour, improvised equipment and manual techniques. In 2009 the bulk carrier FULL CITY grounded off Langesund spilling estimated 1,154 tonnes of heavy fuel oil (IFO 180) which subsequently contaminated about 100km of shore. Due to the rocky, heavy-indented nature of the coastline, clean-up was logistically difficult and was mainly carried out manually with limited use of heavy machinery or aggressive cleaning techniques. The container ship GODAFOSS grounded in southern Norway, 10km from the Swedish border, in February 2011 and about 120 tonnes of IFO 380 was released into the sea. Over 500 birds, mainly eider ducks, were estimated to have been oiled. The presence of large quantities of sea ice, coupled with temperatures of around -20℃, posed a challenge to ordinary spill response techniques and strategies. One of the more effective techniques involved a combination of brush belt skimmers assisted by steam heating jets which enhanced the separation of oil from ice. This incident provided an opportunity to observe the Copenhagen agreement in action, which facilitated the integration of the Swedish Coastguard into the response operation.

After these accidents, NCA concluded that impacts of a spill on the marine environment is dependent on its size, timing and location, and on the oil type, season and the presence or absence of vulnerable nature resources (Experience from oil spills, 2012). In addition to this, environmental monitoring was initiated the first twenty- four hours after the oil spill occurred (Experience from oil spills, 2012).

2.5 Oil Spill Response in U.S.

2.5.1 The Outline of Oil Spill Response in U.S.

The sequence of events following the Deepwater Horizon oil blow-out will be given below. However, first a description of the U.S. oil spill response will be given. This section focuses on legal basis, contingency plan and chain of command.

In U.S. The Oil Pollution Control Act of 1990 (OPA) was created for a comprehensive prevention, response, liability, and compensation regime to deal with vessel- and facility- caused oil pollution to U.S. navigable waters (United States Coast Guard, 2016). The organization of OPA includes setting new requirements for vessel construction and crew licensing and manning, mandating contingency planning, enhancing federal response capability, broadening enforcement authority, increasing penalties, creating new research and development programs, increasing potential liabilities, and significantly broadening financial responsibility requirements (United States Coast Guard, 2016).

In the U.S. the protection of the marine environment is the responsibility of the Federal Government. For this purpose, a National Contingency Plan (NCP), Regional Contingency Plans (RCP) and Area Contingency Plans (ACP) have been established. NCP is the federal government's blueprint for responding to both spills of oils and hazardous substances (US Environmental Protection Agency). The legal basis of this plan is the Comprehensive Environment Response, Compensation, and Liability Act of 1980, article 105. The first NCP was developed and published in 1968 in response to the massive oil spill from the oil tanker Torrey Canyon off the coast of England. To avoid the problem faced by response officials involved in this accident, U.S. officials developed a coordinated approach to cope with potential spills in U.S. waters. The first plan provided the comprehensive system of accident reporting, spill containment and clean up. The plan also established a response headquarters, a national reaction team and regional reaction teams. Congress has broadened the scope of the NCP over the years. As required by the Clean Water Act of 1972, the NCP was received to include a framework for responding to hazardous substance release, as well as oil spills. Following the passage of Superfund legislation in 1980, the NCP was broadened to cover release at hazardous waste sites requiring emergency removal actions. Over the years, additional revisions have been made to NCP to keep pace with the enactment of legislation. The latest revisions to the NCP were finalized in 1994 to reflect the oil spill provisions of the Oil Pollution Act of 1990.

In U.S. the chain of command is well organized. An important part of this organization is the "Federal On Scene Coordinator (Federal OSC)". Federal OSC are the federal officials predesignated by U.S Environmental Protection Agency (EPA) and the U.S. Coast Guard (USCG) to coordinate the overall response to the emergency.

Federal OSC is a designation for an individual that is responsible for providing access to federal resources and technical assistance, coordinates all federal containment, removal, and disposal efforts and resources during an oil or hazmat incident. The Federal OSC serves as the point of contact for coordination of federal efforts with the local response community, coordinates, monitors, or directs response efforts.

During an oil or hazmat incident, EPA will usually provide OSCs in the inland zone, and the USCG will generally provide OSCs in the coastal zone. The OSC coordinates all federal containment, removal, and disposal efforts and resources during an incident under the NCP or the Federal Response Plan (FRP). The OSC is the point of contact for the coordination of federal efforts with those of the local response community. EPA has approximately 200 OSCs at 17 locations nationwide; USCG has 46 Marine Safety Offices (MSOs), spread among the nine USCG Districts, each of which is headed by a Captain of the Port (COTP), who acts as an OSC.

Under the NCP, OSCs have the responsibility to oversee development of the Area Contingency Plan (ACP) in the area of the OSC's responsibility. The NCP states that the development of ACPs should be accomplished in cooperation with the Regional Response Team (RRT), and designated local and state representatives, as appropriate. In both contingency planning and spill response, the OSC is responsible for coordinating, directing, and reviewing the work of other agencies, Area Committees, RPs, and contractors to ensure compliance with the NCP and other plans applicable to the response.

In conclusion, managing oil spill is based on enhancing the power of OSCs. The responsibility of OSCs is assessment, monitoring and response assistance. Firstly, the assessment involves evaluating the size and nature of a release or spills, its potential hazards, the resources needed to contain and clean it up, and the ability of the responsible party or local authorities to handle the incident.

Secondly, in the case of oil spills, the OSC is legally required to monitor the response if the spill poses a substantial threat to the health and welfare of the public due to its size or characteristics.
Thirdly, once a release or spill has been assessed, the OSC determines whether federal assistance will be necessary to help control and contain it (US Environmental Protection Agency, N.D).

2.5.2 Exxon Valdez Oil Spill Accident

The Exxon Valdez oil spill was a major oil spill which occurred in Prince William Sound, Alaska, starting March 24, 1989. According to official reports, the ship was carrying approximately 55 million US gallons (210,000 m^3) of oil, of which about 10.1 to 11 million US gallons (240,000 to 260,000 bbl.; 38,000 to 42,000 m^3) were spilled into the Prince William Sound. This oil spill accident triggered the development of the Oil Pollution Control Act. Below a review is given regarding the impacts of the Exxon Valdez oil spill as well as some of the lesson learned based on the report to the president.

The report to the president, note effects on birds, marine mammals, and fisheries. When the accident occurred, the Fish and Wildlife Service (FWS) counted more than 91,000 water birds (waterfowl or shorebirds) around the accidental are. Then many of birds may be affected either directly by oil or indirectly through the loss of food sources. Therefore, the 4,463 dead birds collected do not represent the full toll. Around the accidental area, twenty-three species of marine mammals live either year-round or during the summer. These mammals include gray, humpback, and killer whales, various porpoises and dolphins, harbor seals, sea lions, and sea otters. Although the experts have different opinions, one researcher says that 2,800 to 5,000 sea otters died because of direct and indirect effects of the oil spill. Oil can affect microscopic plants (phytoplankton) and animals (zooplankton) adversely. For some species morality of planktonic eggs and larvae may result in long-term population effects.
Long-term effects to the area's rich biota may result from food chain and habitat disruption as well as from decreased survivability and reproductive capability of

animals directly exposed to oil. Another economically significant long-term effect could be the possible loss of this year’s young herring from the affected areas.

2.6 Conclusion

In this chapter, reviewed the oil spill response in Japan, Norway, and U.S. In the Japanese case, the contingency plan for oil spills was revised after the Nakhodka oil spill. The plan notes the responsibility scheme (essentially, JCG will be in charge of the large oil spill), and also show the communication flow among the national government, local government and the concerned ministries/agencies.

The Norwegian oil spill response, their system consists of multi-level management and a complex structure with private, municipal, and state level actors (Figure 4). To clarify this complex management framework, the key legislation is the “Pollution Control Act” and the key agency is the Norwegian Coastal Administration. Based on the Pollution Control Act, multi-level management may be mobilized to act as one integrated national system. The leading agency is the Norwegian Coastal Administration, especially the Department of Emergency Response. This department is responsible for maintain the national contingency, including all three (private, municipal and state) levels. In addition, the NCA has the formal role to coordinate with related organization. The Climate and Pollution Agency(Klif) and the Norwegian Coastal Administration (NCA) have issued documents/guidelines that clarify the assessments needed to be documented in emergency response analyses and in the oil spill contingency plans or before dispersants can be used.

The U.S. response system is described in the National Contingency Plan legally based on the Oil Pollution Act of 1990. This legislation stipulates a Federal On Scene Coordinator (Federal OSC) who is in charge of oil spill response. The Federal OSC will be predesigned from United States Environmental Protection Agency (EPA) or United States Coast Guard (USCG) to coordinate response sources.

Chapter3 Oil Spills from Offshore Industry

3.1 Offshore Oil Platform

3.1.1 Types, Mechanism and Riskiness

An offshore oil or gas platform is a large structure with facilities to drill wells, to extract and process oil or nature gas, and/or to temporarily store product until it can be brought to shore for refining delivery to the market. In this section, it clarifies the types, mechanism and riskiness of the offshore oil and gas platform.

According to NOAA, Types of offshore oil and gas structures are categorized with 7 types, 1, 2) conventional fixed platforms: 3) compliant tower; 4, 5) vertically moored tension leg and mini-tension leg platform; 6) Spar; 7,8) Semi-submersibles; 9) Floating production, storage, and offloading facility; 10) sub-sea completion and tie-back to host facility (Fig.9) (NOAA, 2005).

One type of offshore platform used in some offshore oil and gas fields in the world is the semi-submarine platform. These platforms have hulls (columns and pontoons) of sufficient buoyancy to cause the structure to float, but of weight sufficient to keep the structure upright. Semi- submersible platforms can be moved from place to place and can be ballasted up or down by altering the amount of flooding in buoyancy tanks. They are generally anchored by combinations of chain, wire rope or polyester rope, or both during drilling and/or production operations, though they can also be kept in place by the use of dynamic positioning. Semi- submarine platform is one of the common type platform. For instance, Deepwater Horizon which are used in Gul of Mexico, and the platform used in Iwafune-oki, which is located in Japanese water is also this type of oil platform.

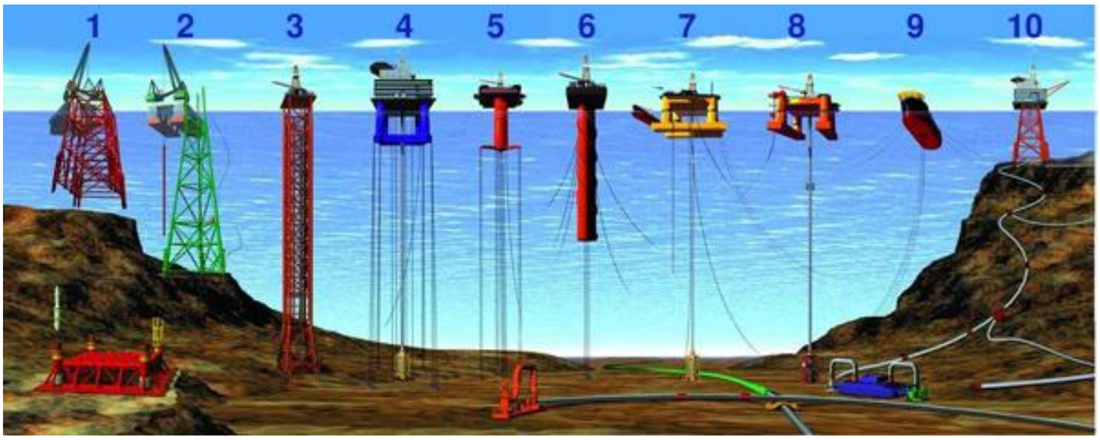

Fig.9 Types of Offshore Oil and Gas Platform

Source: NOAA OCEAN EXPLORE

3.1.2 Offshore Oil Platform in Japan

The Japanese offshore (oil and gas) industry is developing rapidly against all odds. Presently Japan has only one platform for oil and gas production, placed in the Iwafune–oki oil and gas field. This oil and gas field was discovered in 1983 and production was commenced in 1990. The offshore platform was settled at 36meters depts, and cumulative oil production reached 5 million kilolitres in 2012.

3.2 A Case Study Deepwater Horizon Oil Spill in the Unites States

3.2.1 Analysis of the Cause of the Accident and Impact

The world's largest accidental release of oil occurred in 2010 when the offshore drilling rig, DEEPWATER HORIZON, suffered an explosion and subsequently sank in the Gulf of Mexico, releasing an estimated 4.9 million barrels of oil into the marine environment (ITOPF, 2012). The platform was 396 feet (121m) long and 256 feet (78m) wide and could operate in waters up to 8,000 feet (2400m) deep, to a maximum drill depth of 30,000 feet (9,100m) (Transocean, 2010). The platform had historically been used for deep wells, including the deepest underwater gas and oil well in history at 35,055 feet (10,685m) in 2009 (Transocean, 2010). At the time of the explosion, the rig was drilling an exploratory well. There are 6 main causes of this accident. 1. Small diameter hole obstructed mud circulation, 2. Valves to prevent cement backflow did not close, 3. Cementing inadequate, 4. Pressure test wrongly interpreted, 5. Rising oil and gas not monitored, 6. Fail-safe on seabed wellhead was unable to close.

3.2.2 Correspondence to This Accident

Time series of BP oil spill disaster (Gurdian research, 2010)

On 20 April

Explosion and fire on Deepwater Horizon. 11 people are reported missing and approximately 17 injured. A blowout preventer, intended to prevent release of crude oil, failed to activate.

On 22 April

Deepwater Horizon rig sinks in 5,000ft of water, Reports of a five-mile-long oil slick. Search and rescue (SAR) operations by the US National Response Team begins.

On 23 April

The rig is found upside down about a quarter-mile from the blowout preventer. A Homeland Security Department risk analysis says the incident “poses a negligible risk to regional oil supply markets and will not cause significant national economic impacts”. White House press secretary says: “I doubt this is the first accident that has happened and I doubt it will be the last”.

On 24 April

Oil is found to be leaking from the well. A Homeland Security report on critical infrastructure says the problem has “no near-term impact to regional or national crude oil or natural gas supplies”.

On 25 April

US coast guard remote underwater cameras report the well is leaking 1,000 barrels of crude oil per day (bpd). It approves a plan for remote underwater vehicles to try to activate a blowout preventer and stop the leak.

On 27 April

The US Department of Interior and the Homeland Security Department announced plans for a joint investigation of the explosion and fire. The Coast Guard announces it will set fire to the leaking crude to slow the spread of oil in the Gulf. Minerals Management Services (MMS) approves a plan for two relief wells. The Homeland Security Department's infrastructure and risk analysis center reports: "Release of crude oil, natural gas and diesel fuel poses a high risk of environmental contamination in the Gulf of Mexico".

On 28 April

The Coast Guard says the flows of oil is 5,000 bpd, five times greater than first estimated, after a third leak is discovered. Controlled burns begin on the giant oil slick.

On 29 April

President Obama talks about the spill at the White House, his first public comments on the issue. He pledges "every single available resource". Including the US military, to contain the spreading spill, and also says BP is responsible for the clean-up.

Louisiana declares as a state of emergency due to the threat to the state's natural resources, as the oil slick approaches land.

On 30 April

An Obama aide says no drilling will be allowed in new areas until the cause of the Deepwater Horizon accident is established.

As the countermeasure to this accident, dispersants were used on an unpresented scale following the incident, about 40% of which were injected at the source of the spill 1.5km below the sea surface. In-situ burning was also used in an effort to minimize impacts to the shoreline and sensitive resources and is estimated to have eliminated approximately 5% of the total volume spilled. A number of factors contributed towards the successful use of burning in this case, primarily the distance from the shoreline, which reduced concern about the potential impact on public health of harmful or prolonged smoke exposure, and the continuous supply of fresh oil from the well head, which extended the “window of opportunity” to use the technique (ITOPF, 2012).

3.2.3 Environmental Impact of the Oil Spill

After this accident, many environmental impacts were reported. The environmental accident will be categorized according to impacts by the oil itself, and the impacts caused by the clean-up.

Firstly, an oil spill affects marine environment directly in a number of ways. In the DEEPHORIZON case, it is reported that marine organisms including corals, dolphins, seabirds were affected by the oil spill. In addition, the beaches were also affected by the oil spill. A study of the sands of the contaminated beaches and marshes showed that the variety of organisms including those at the, lowest levels of the food chain, had dropped dramatically since the spill (Halanych, 2012).

The clean-up activities also caused impacts. The use of dispersants is one such activity. Also, beach clean-up resulted in damage to the vegetation and in some cases erosion. Scientists and fisherman are pointing to the spill, the dispersants and chemicals used in its clean up as the cause of mutated fishes (Jamail, 2012). A 2014 study of the effects of the oil spill on Bluefin tuna, published in the journal Science, found that oil already broken down by wave action and dispersants was more toxic than fresh oil (Tuna study reveals how pollution causes heart problems, 2014). The use of dispersants also affected the beaches. They made oil sink faster and more deeply into the beaches, and possibly groundwater supplies. The researchers found that Corexit EC 9500A which was the most widely used dispersant allowed the PAHs to permeate sand where, due to a lack of sunlight, degradation is slowed (GAYLE, 2012). However, others points at the advantages of using dispersants in this case. The results of the current study demonstrate that microbial populations are susceptible to toxicity from the use of Corexit EC 9500A when applied at a prescribed concentration (Hamdan, 2011). Then hydrocarbon degradation in the marine environment is dependent on the ability of microorganisms to utilize hydrocarbons for growth and metabolism. Therefore, using dispersants in this case is a good effect to recovery the environment.

3.2.4 Lesson Learned from DEEPWATER HORIZON Oil Spills

After the DEEPWATER HORIZON oil spill accident, National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling made the report to the president. In this section, it clarifies the recommendations, especially about oil spill response, planning and capacity. According to the commission's recommendations, they address three critical issues or gaps in the government's existing response capacity: (1) the failure to plan effectively for a large-scale, difficult-to-contain spill in the Deepwater environment or potentially in the Arctic; (2) the difficulty of coordinating with state and local government officials to deliver an effective response; and (3) a lack of information and understanding concerning the efficiency of specific response measures, such as dispersants and booms (DEEPWATER, 2011).

(a) The Need for Improved Oil Spill Response Planning

The Department of the Interior should create a rigorous, transparent, and meaningful oil spill risk analysis and planning process for the development and implementation of better oil spill response.

The Department of the Interior should review and revise its regulations and guidance for industry oil spill response plans in light of the lessons learned from the *Deepwater Horizon* experience. A new process for reviewing spill response plans is needed. This process should ensure that all critical information and spill scenarios are included in the plans, including oil spill containment and control methods to ensure that operators can deliver the capabilities indicated in their response plans. In addition, the new entity within Interior that is charged with overseeing offshore safety and environmental protection will have to verify operator capability to perform according to the plans.

(b) The Need for a New Approach to Handling Spills of National Significance

Environmental Protection Agency (EPA) and the Coast Guard should establish distinct plans and procedures for responding to a "Spill of National Significance."

(c) The Need to Strengthen State and Local Involvement

EPA and the Coast Guard should bolster state and local involvement in oil spill contingency planning and training and create a mechanism for local involvement in spill planning and response similar to the Regional Citizens' Advisory Councils mandated by the Oil Pollution Act of 1990.

3.3 Assumption in Japan

As already discussed in Chapter 2, Japan established and renewed its national, regional and area contingency plans. The national contingency plan, clearly show the chain- of command when an oil spill has occurred, and the plan also establish the communication chain. In addition, Japan also has upgraded the mechanical and chemical oil spill response equipment in both government and private sectors.

This this section analyses preparedness for oil spills from the offshore industry based on regional and area contingency plans.

3.3.1 Sakhalin-Ⅱ project

3.3.1.1 Local Contingency Plan

Sakhalin Energy Investment Ltd which is a major actor in the area has developed their preparedness based on a worst-case scenario which is the blowout accident in the Piltun Astokhskoye platform. The amount of blowout in the scenario is 1,270kl/day in a total of 10 days. Sakhalin Energy Investment Ltd note that they can manage this oil spill by using their equipment and the equipment of their contractors. However, under certain conditions the oil spill will also affect the north part of Japan. Therefore, after launching this project, the local contingency plan (Hokkaido coastal area) will be added to this project. According to this plan an assumed oil spill from Piltun Astokhskoye and the assumed response to it is described in section 4 (13 pages). Their oil spill response is classified 6 chapters (see below).

Chapter 1. Weather and sea conditions
Chapter 2. Sakhalin offshore oil field
Chapter 3. Assumption of marine pollution
Chapter 4. Available oil spill control equipment
Chapter 5. Prevention of oil spill
Chapter 6. Procedure Proceeding of collected oil

This plan is included with HOKKAIDO coastal local contingency plan, and after launching Sakhalin project, JCG added the section about preparedness to this project. According to this regional contingency plan, they note the possibility about drifting ashore in Japan, in case of a major oil spill accident in Sakhalin offshore oil field. The assumption is as below.

1. When the blowout accident in the oil field occurred, approximately 1,270 kl of crude oil spilled to the sea.
2. The oil spill cannot be controlled for up to three days, because of stormy sea weather.
3. About 30% of the spilled oil evaporated to the air and dispersed naturally into the water. The remaining oil, about 2,700kl transformed into mousse, and the volume of oil-and-water expanded 3 to 5 times, to approximately 8,000kl to 13,000kl. This high viscosity oil started to drift towards the Japanese coast.
4. This assumption is based on the summer season event, because the flow of ocean current is the most earliest in that season. The oil is expected to be reached around Hokkaido waters in 26 days. In 32 days after the oil spill accident, the oil is expected to reach HOKKAIDO coastal area, which is located 540 miles from Sakhalin offshore oil field.

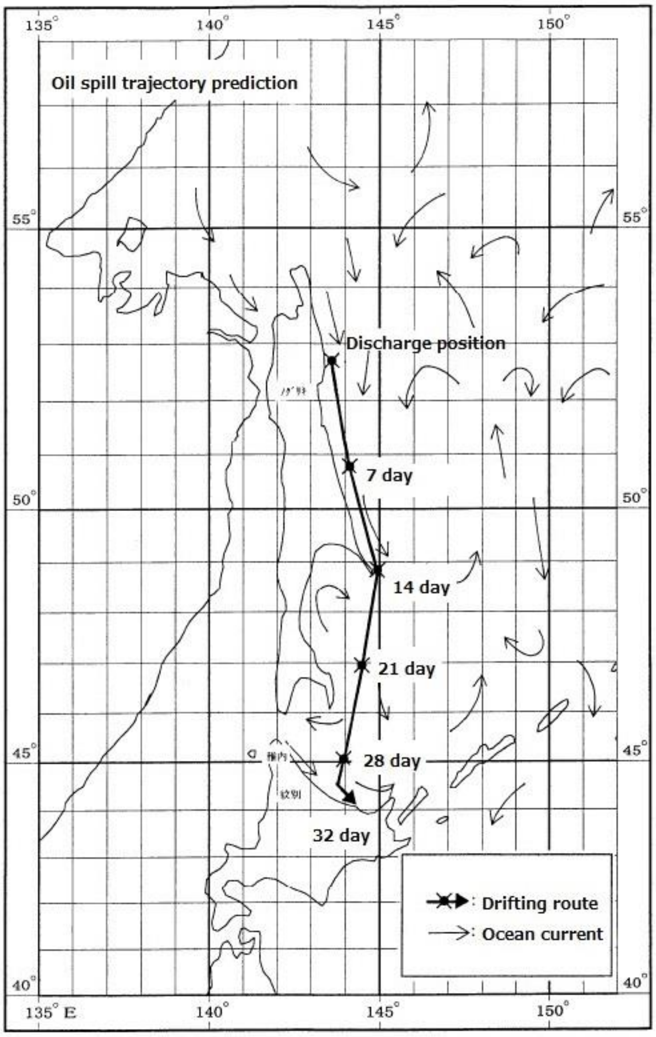

Fig.10 Oil Spill Trajectory Prediction

Source: Japanese Local Contingency Plan

3.3.1.2 Area Contingency Plan

In addition to the local contingency plan, which JCG established (referred 3.3.2), Sakhalin Energy Investment Company Ltd. (Sakhalin Energy) and Japan's National Maritime Research Institute developed an Area Contingency Plan for the Northern Coastal Hokkaido area (area plan). The scope of this contingency plan analyses the affected area, when a vessel source oil spill accident occurs in Aniva Bay or Le Perouse Strait.

The basic concepts of this area plan are on-site security, prevention of the spill at the source, removing spilled oil which is considered an environmental risk, and protection of property. To implement these concepts, this area has a strategy section, beach cleaning guidelines, and dispersants use guidelines. The strategy section includes oil collecting points and how to arrange oil booms. The content of this area plan is as followed.

Chapter 1. Overview, and assumed scenario
Chapter 2. Oil spill preventing strategy
Chapter 3. Oil spill preventing tactic
Chapter 4. On-site safety and logistical support
Appendix A. Organization chart
Appendix B. Oil spill assessment manual (offshore)
Appendix C. Oil spill assessment manual (onshore)
Appendix D. Beach cleaning guideline
Appendix E. Environmental impact guideline of beach cleaning
Appendix F. Offshore Recovery guideline in Hokkaido north coastal area
Appendix G. The guideline of spraying dispersants in Hokkaido north coastal area
Appendix H. Oil spill response equipment in Hokkaido north coastal area
Appendix I. Logistic support guidance

In this plan, the acute oil spill will be categorized according to tier 1, tier 2, and tier 3 based on guidelines from International Maritime Organization (IMO) and the International Oil and Gas Industry Association for Environmental and Social Issues (IPICA). Tierc1 is an oil spill with an amount of spilled oil up to ～100kl. This plan assumes that the oil spill of tier 3 will affect to Japanese coastal area. The amount of spilled oil is over 100kl, and the cause of oil spill is the tanker collision or grounding from the Sakhalin area.

The characteristics of this area plan are as follows: The area plan contains dispersant use guidelines. A novel part of these guidelines is that they establish “Spraying avoidance area” and “Spraying agreement area”. Spraying avoidance area is the area where the organizations cannot spray dispersants. These areas are decided among stakeholders in advance. According to Japan's National Maritime Research Institute, dispersants will not sink under 10 meters, mostly they will sink to about 8 meters. Therefore, Japan's National Maritime Research Institute decided that dispersants can be spray at depths deeper than 20 meters. In addition, adjusting to demands from the fishing industry, they decided to prevent spraying dispersants closer than 2 miles from shoreline. However, this guideline also notes that the organization has to discuss with stakeholders before spraying dispersants.

3.3.1.3 Environmental Impact

Regarding the environmental issues related to Sakhalin-Ⅱ project, Sakhalin Energy Ltd. published several documents including an Environmental Impact Assessment (EIA) based on internationally accepted standards, and the EIA-Addendum (EIA-A). Environmental impact is categorized as the effects caused by the construction of the platform, and those caused by oil spills from vessels or the platform itself.

The laying of the pipeline may impact the ecosystem due to siltation and physical damage to the seabed habitats. Also noise during the piling in connection with the establishment of the platform may be destructive to the environment. In addition, vessels used during the construction may case contamination such as spills and air emissions, and they may cause damage to slow-swimming marine mammals (strikes). In particular the North-western Pacific Gray Whale is highly threatened and very vulnerable. According to IUCN's Expert Panel on the Gray Whales of the area there are only less than 200 individuals left of this species. Some of these impacts may also affect Japanese waters. The affected species are sea lions or seals. The number of sea lion is decreasing now. The IUCN considers sea lion as endangered (EN) in the IUCN Red List of Threatened Species. There are colonies in isolated islands in the Sea of Okhotsk and Kuri islands. These sea lions migrate to Hokkaido in Japan. Four types of seals also occur in the Sea of Okhotsk. They breed on the ice. They follow the ice to Hokkaido during the winter season, then they live in the Sea of Okhotsk during summer season. Seals are one of the tourist attractions in Japan. Therefore, the oil spill impact is large for not only their habitats, but also tourist industry.

3.3.2 Iwafune-oki Oil and Gas Field Case

Iwafune-oki oil and gas field case is in Hokuriku coastal area. However, the local contingency plan which is made by JCG does not give any information about this offshore platform. The amount of output has decreased recently. However, it is important to prepare for an accident. In general, the assumption of oil spill from offshore industry is easier than a vessel source oil spill. The location and the type of oils are already known, and meteorological and sea conditions are also well known. Therefore, JCG should consider the existence of this platform in the local contingency plan and make scenarios for accidental spills.

Chapter4 Analysis and Discussion

4.1 Evaluation

4.1.1 National Response Capacity

This section analyses the number of and capacity of oil spill response equipment. The typical oil spill response equipment are booms, dispersants, deployment/recovery vessels and oil skimmers. Among that, Table1 and 2 shows the number of oil recovery vessels and the number of oil skimmer in Japan (based on calculations by the author from Japan's local contingency plan).

	Oil recovery vessel in Japan	Number of vessel	Total tonnage (GT)	Total oil recovery rate (kl/h)
1	HOKKAIDO coastal area	1	50	80
2	TOUHOKU coastal area	6	1059	326.8
3	TOKYO bay	9	689.6	492
4	KANTO-TOKAI eastern coastal area	3	134	77.4
5	ISE bay	6	5448.17	1325
6	TOKAI western coastal area	3	94.93	170
7	OSAKA bay-HARIMANADA coastal area	12	1116.95	484
8	SHIKOKU southern coastal area	0	0	0
9	SETO inland sea eastern coastal area	5	304.51	245.9
10	SETO inland sea middle coastal area	4	340.73	167
11	SETO inland sea western coastal area	7	5309	1676
12	KYUSYU southern coastal ara	5	242.5	118.6
13	SANIN coast・WAKASA bay area	1	320	89
14	HOKURIKU coastal area	3	4439	1402
15	KYUSYU southern coastal area	4	544	224
16	OKINAWA coastal area	1	99	100

Table2 The Number of Oil Recovery Vessels in Japan

Source: Japanese National Contingency Plan

	Oil skimmer in Japan	Number of oil skimmer	Number of installation place	Oil recovery rate (kl/h)
1	HOKKAIDO coastal area	23	17	902
2	TOUHOKU coastal area	22	21	436.04
3	TOKYO bay	53	29	919.6
4	KANTO-TOKAI eastern coastal area	7	7	100.5
5	ISE bay	22	13	335
6	TOKAI western coastal area	0	0	0
7	OSAKA bay-HARIMANADA coastal area	37	24	567.2
8	SHIKOKU southern coastal area	1	1	25
9	SETO inland sea eastern coastal area	17	11	726
10	SETO inland sea middle coastal area	28	18	450.4
11	SETO inland sea western coastal area	9	8	432
12	KYUSYU southern coastal ara	25	19	383.6
13	SANIN coast・WAKASA bay area	8	7	340
14	HOKURIKU coastal area	16	12	660
15	KYUSYU southern coastal area	15	15	713.7
16	OKINAWA coastal area	16	10	351

Table3 The number of oil skimmer in Japan

Source: Japanese National Contingency Plan

Japan's National Contingency Plan does not specify a particular size of an oil spill that the country's capacity should be able to deal with. Several other countries have designed their capability according to a given amount of oil in the spill. However, each local contingency plan includes an oil spill scenario. When considering the corresponding capacity, one method is given by the National Response Capacity (NRC). NRC was calculated with following considerations such as efficiency, mobilization efficiency and operating capability of response personnel after calculating mechanical recovery capability of oil recovery ships and oil skimmers (Lee, 2001). The formula of NRC is as below.

NRC(kl)= recovery Capacity (kl/h) × Working Hours (3days × 8hours/day) × Mechanical Efficiency (0.2) × Mobilization Efficiency (0.33) × Operating Efficiency (0.65)

When using this formula and applying the data in Table 1 and Table 2 the figure obtained is 14,700 kl on the entire national level. In the absence of other assessments, this formula may be used to give an indication of the response capability.

4.1.2 PSM and RETOS™

Process Safety management (PSM) is an analytical tool focused on preventing release of any substance defined as a highly hazardous chemical. According to OSHA3132-PSM, the principles of PSM is that if, despite the best planning, an incident occurs, it is essential that emergency pre-planning and training make employees aware of, and able to execute, proper actions (Herman, 2000). The tool which the concept of PSM applied to oil spill response is RETOS™. Readiness Evaluation Tool for Oil Spills (RETOS™) was developed to assist governments and companies in assessing their level of oil spill response planning and readiness management in relation to commonly agreed pre-established criteria considering international Best Management Practices. This tool is suggested in 2008 International Oil Spill Conference. However, as far as we know it is not mandatory anywhere. According to Regional Association of Oil, Gas and Biofuels Companies in

Latin America and the Caribbean (ARPEL), this tool has already used in some countries (including Norway and U.S, but Japan has not used yet). The key feature of this tool is that RETOS™ can be used to create similar tools and assess the level of emergency management readiness in relation to PSM pre-established criteria. This tool can show the global performance (refer to fig.10). Therefore, it will be useful for Japan to consider about oil spill response system.

Global Performance Analysis Results

Category	Value
Legislation, Regulations, Agreements	90%
Oil Spill Contingency Planning	85%
Response Coordination	95%
Health, Safety & Security	100%
Operational Response	86%
Tracking, Assessment & Information Management	100%
Logistics	100%
Financial & Administrative Considerations	100%
Training & Exercises	100%
Sustainability & Improvements	83%
Total	**92%**
Institution Specific Criteria	*75%*

#Completed / Number of questions:	58/ 66
Level A Overall Assessment: 92% (In Development)	

Fig. 11 The Sample of Global Score

Source: Using the Reediness Evaluation Tool for Oil Spills in Process Safety Management

4.2 Analysis about Legal Basis and National Contingency Plan

4.2.1 The Defect of Japan's Oil Spill Response in Nakhodka Oil Spill Accident

After the Nakhodka oil spill accident, two defects in the Japan's oil spill response were detected, 1) the management system, 2) the shortage of fundamental information and confusion on-site. As already discussed, some of these issues have already been dealt with in the revised national Oil Contingency Plan.

1) The management system

In the Nakhodka oil spill accident, it was criticized that the management system was not effective. In Japan, the jurisdiction of Coast Guard is at sea, and local governments manage the coastline. Therefore, when the oil spill occurred, JCG collected the oil in the sea, and the local government collected the oil which drifted to the shoreline. In addition, the environment agency managed the environmental matters, and the fishery agency was in charge of fishing industry. Therefore, there was not the integrated management, and the response was not coordinated (Shikida & Kato 2003).

After the accident, the deficiencies in the management system was noted and JCG set up an office to deal with the problems. In particular, the revised National Contingency Plan establish that the government sets up "Alert Headquarters" in JCG headquarters, and also establish "The on-site Liaison and Coordination Headquarters" at the accident site.

2) The shortage of fundamental information and confusion on-site

In the Nakhodka oil spill accident, the shortage of fundamental information disrupted the work on-site. In particular, no expert advice was available because of New Year holidays. In addition, the on-site did not have enough information about the hazards, local environment, different approaches to collection of oil spills, and drifting forecasts were missing (Shikida & Kato, 2003).

In response to these issues, JCG made three changes in order to better be able to be better prepared to respond to oil spill accidents, enhancing the structure of National Strike Team, advancement of the Trajectory Prediction, and making the ESI maps.

4.2.2 Can Japan Handle the Big Oil Spills

After the Nakhodka oil spill accident, Japan has improved oil spill response from vessels in both in terms of improving the knowledge and in the form of hardware. Luckily, Japan has not experienced and large oil spill accidents since the Nakhodka oil spill. So, it is not concluded that they can handle the certain of the amount of oil spill. However, as this thesis clarifies, their response and preparedness improved in both of the hard and the soft aspects.

4.3 Recommendations

Based on the analysis, this paper has three recommendations to Japan's oil spill response. First, clear standards are needed regarding the use of dispersants. Second, is the need to include spills from the offshore industry in the contingency plans. The last one is the reviewing system after the disaster.

1) Establishing the clear standards about using dispersants.

As already discussed, Japan's oil spill response is mostly focused on using mechanical one (booms, skimmers, etc.), and the Norwegian response is the same. This is because both countries' fishing industry is prosperous. In Deepwater Horizon accident, it was reported that the environmental damages, which were affected by not only oil itself, but also using dispersants. Therefore, the prior understanding of stakeholder is inevitable to use them. In addition, the choice and timing is other issue to use dispersants. According to ITOPF, there are some limitations of dispersants, sea condition, oil properties, and conflicts with other response methods. Therefore, it is important to have the prior consultation with stakeholders and note the timing and usage standard in contingency plan.

In the area contingency plan for Sakhalin-Ⅱ oil spill accident, they made the guideline about spraying dispersants. However, this is the special case. In this case it is clear that the site of incidence, and the type of oil, because of the oil spill from offshore industry. In Japan’s future oil spill response scheme, they shall note the usage standard clearly based on prior consultation with stakeholders.

2) The assumption of the offshore oil industry oil spills.

As already discussed in Chapter 3, oil spills are not only caused by ships, but also the offshore oil and gas industry. Actually, the number of the vessel oil spill accidents are decreasing, because of IMO regulations. Deepwater Horizon oil spill accident is still fresh in our minds. Therefore, contingency plans should also consider this type of oil spills. In Japan, they researched some offshore oil and gas field, and there are some offshore oil and gas field around Japan. Moreover, an accident during the Sakhalin-Ⅱproject may affect to Japan’s marine environment. According to Polluter-Pays Principle, Sakhalin Energy Investment Ltd, which operate this offshore platform make the contingency plan to respond to a blowout. The oil and gas field is located in Russia, however, the spilled oil may be carried to Japanese coast in the certain sea conditions. Therefore, the local contingency plan (HOKKAIDO coastal are) should consider spills of this type.

However, national and local contingency plan which were made Japan’ Coast Guard did not note anything about the offshore oil industry around Japan. They shall write and predict the accidents

3) Making the review system after the oil spill disaster.

The last one is the reviewing system on National Contingency Plan, and Local Contingency Plans. Presently the National Contingency Plan stipulates that government considers the development continuously, and review the plans, when it is necessary. The local Contingency Plans writes that they consider the plan every year, and they reflect opinions from the local oil spill response council based on the Act on prevention of marine Pollution and maritime Disaster article 43, 6, 2. In addition, they note the relationship between JCG and concerned administrative authorities and local government. When JCG review the plan, they have to listen the opinions from the manager of concerned administrative authorities and local governments. Also, JCG have to notice the reviewing points to them, when JCG change the plan. As National Commission on Deepwater Horizon Oil Spill and Offshore Drilling said, Government should note the reviewing system in their National or Local contingency plan. The reviewing system should adapt Plan Do Check Action (PDCA) cycle, and apply the lessons of the past to the contingency plan directly. In addition, government should notice the Public Comment Scheme in National and Local Contingency Plans. In recent years, the system of public comment is applied, when ministries make the plan. Therefore, the government and Coast Guard should develop this kind of system, and apply the comment to the contingency plans as a result of lessons learned from future oil spill accidents.

4.4 Conclusion

According to ITOPF report, the number of large oil spill accidents in the world is decreasing. This is because some IMO regulation and the effort of each country. However, it is important to prepare in peacetime. In recent years, Deepwater Horizon oil spill in the Gulf of Mexico is known as the largest oil spill, and the spill caused serious environmental destruction.

Japan has not experienced a large oil spill since the Nakhodka oil spill in 1997. After this oil spill, Japan founded some fault of oil spill response. As a result, the country renewed and rearranged the contingency plans.

In this plan, Japan’s contingency plan clearly notes the chain of command. When a large oil spill occurs, JCG will be in charge of the accident. As the responsible organization and person, government will establish an Alert Headquarter in JCG headquarter, and The On-site Liaison and Coordination Headquarter in the accident site. In this case, the Director General of JCG and Commander of a regional Coast Guard headquarters will be the responsible persons. When a big accident occurs, it is better that one person should have the responsibility and authority. This system is applied in the U.S. response system (Federal On Scene Coordinator).

In addition, Japan made the sensitivity map after the Nakhodka accident. As chapter 2 showed, Japanese Coast Guard made ESI map and also the Coastal Information Service (CeisNet), which is the online map through Web GIS.

However, compared to the system of dealing with oil spills in Norway and the U.S. the Japanese system is different and this paper puts forward the following three recommendations. 1) Establishing the clear standards about using dispersants, 2) The assumption of the offshore oil industry oil spills, 3) Making the review system after the oil spill disaster.

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